(hi-res) Global Model Intensity Forecasts

Mike Fiorino
NOAA ESRL/GSD/AMB

HFIP telcon brief - 20101215

BestTrack Vmax v Model Vmax

$$V_{\max}^{BT} = \alpha V_{\max}^{M} + \beta$$

- *want model V_{max} to represent BT/NHC V_{max}*
- *α = 'aliasing factor' or how the model V_{max} is not representative of the BT*
- *typically model < BT or α>1.0*
- *β = bias :: constant in 'I' trackers*
- *α=1.0; β=0.0 from trackers...*

some meteorology/modeling considerations

$$V_{\max}^{Model} = f(x, y)$$

$$\alpha = f(\Delta t^{M}, \Delta x^{M}, \Delta x^{GRID})$$

$$\alpha > 1$$

- *model intensity depends on track, i.e., TC intensity depends on location relative to synoptic forcing (e.g., shear)*

- α = '*aliasing factor*'
  - BT is 2 min wind, therefore model Vmax depends on model time step/grid spacing/dissipation... – modeling factors
  - data grid spacing (Walsh et al. 2007)

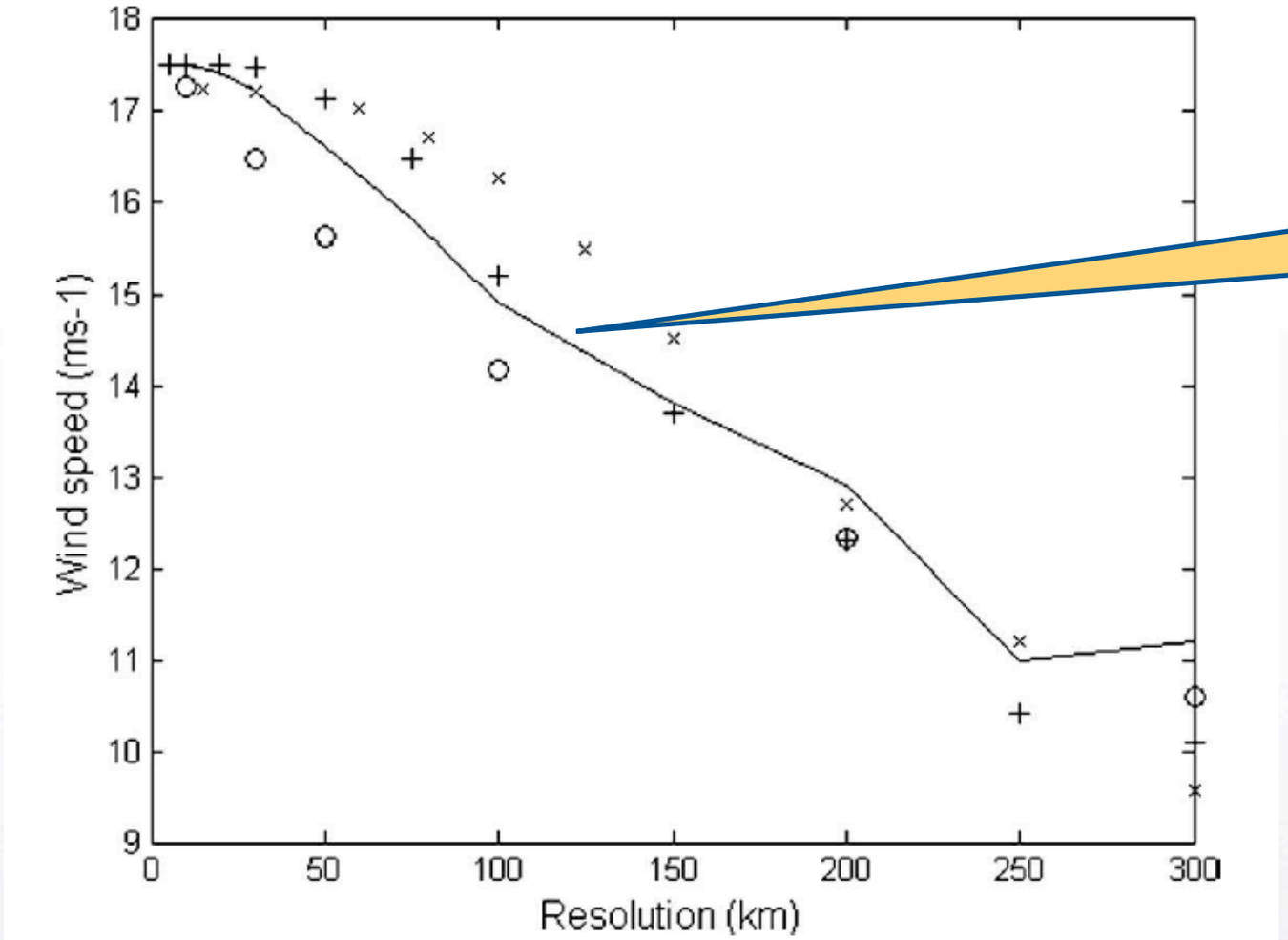
model V_{max} always comes from PostProcessing...

- *Model PostP – V_{max} from model solution*
  - *trackers*
    - dependence on algorithm (!= 0.0 ~ 1-2 kt and 2-5 nm; TM v MF tracker)
    - ***dependence on grid spacing of data grid***
  - 'diag file' :: storm/environment variables for dynamical-statistical models such as SHIPS/LGEM
    - synoptics ⇒ Vmax

- *Tracker PostP – modify the tracker output*
  - ATCF 'l' or 6-h interp/extrap PostP to make 'late' models

aliasing factor from data grid considerations

$$\alpha = f(\ldots, \Delta x^{GRID})$$



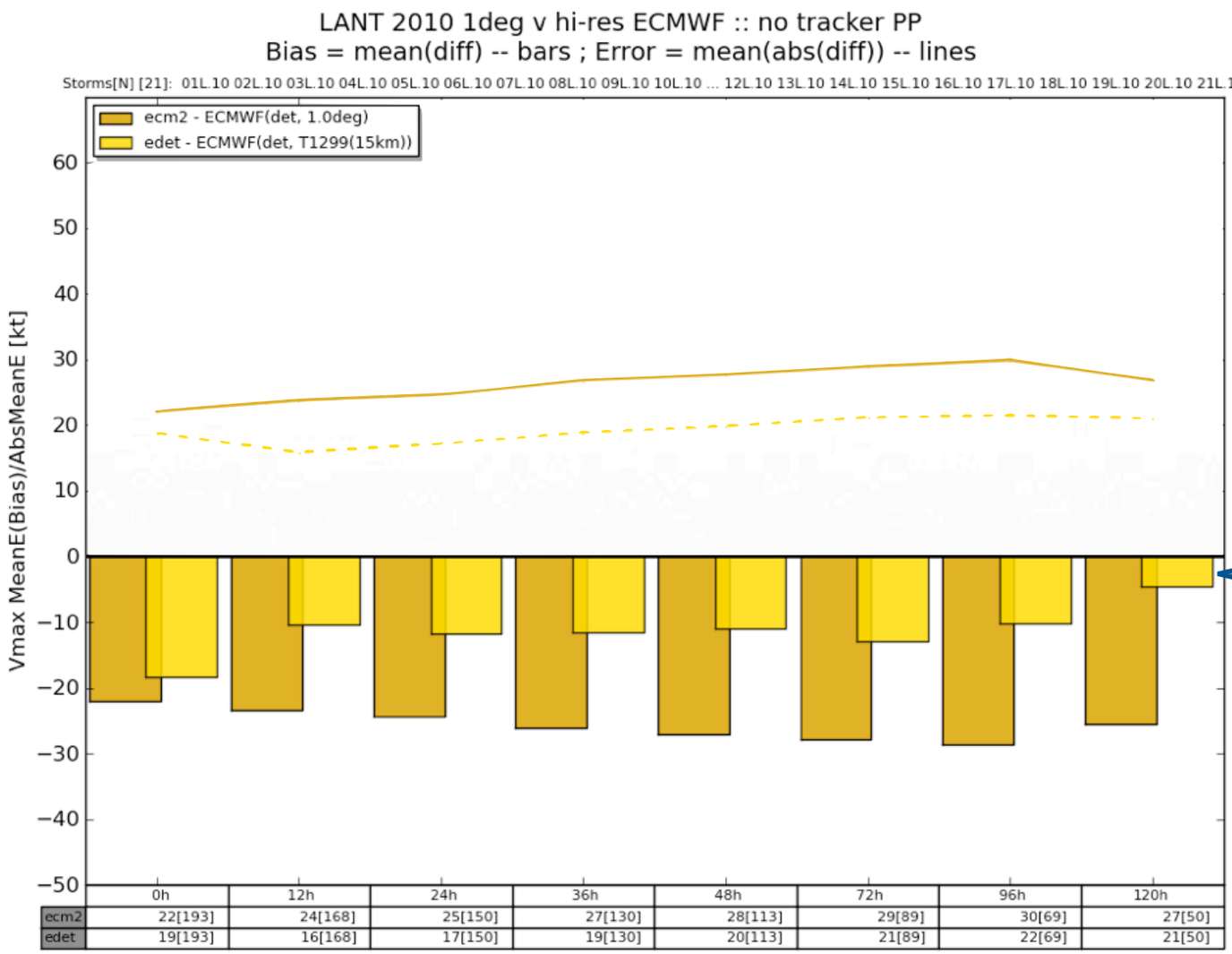
1° v 0.2°grid
15/17.5 ~ 0.85
α ~ 1.17

- *Walsh et al. 2007 (JClim) – how the resolved V_{max} varies with grid resolution for a TS (35 kt) vortex*

intensity metric(s)

- *mean abs error = abs(ModelVmax - BTVmax) = MAE*
  - standard verification
- *mean error = bias*
  - MAE = random if bias = 0
  - if MAE = bias :: no value in forecasting? can't tell if forecast is all bias or actual change?
  - bias in model :: initial vortex 0-48 h; modeling 48-120 h
- *ratio of bias/MAE*
  - low :: useful (?)

tracker dependence on data grid spacing



	0h	12h	24h	36h	48h	72h	96h	120h
ecm2	22[193]	24[168]	25[150]	27[130]	28[113]	29[89]	30[69]	27[50]
edet	19[193]	16[168]	17[150]	19[130]	20[113]	21[89]	22[69]	21[50]

bias at τ120 ~ 4 kt
mean obs ~ 79 kt

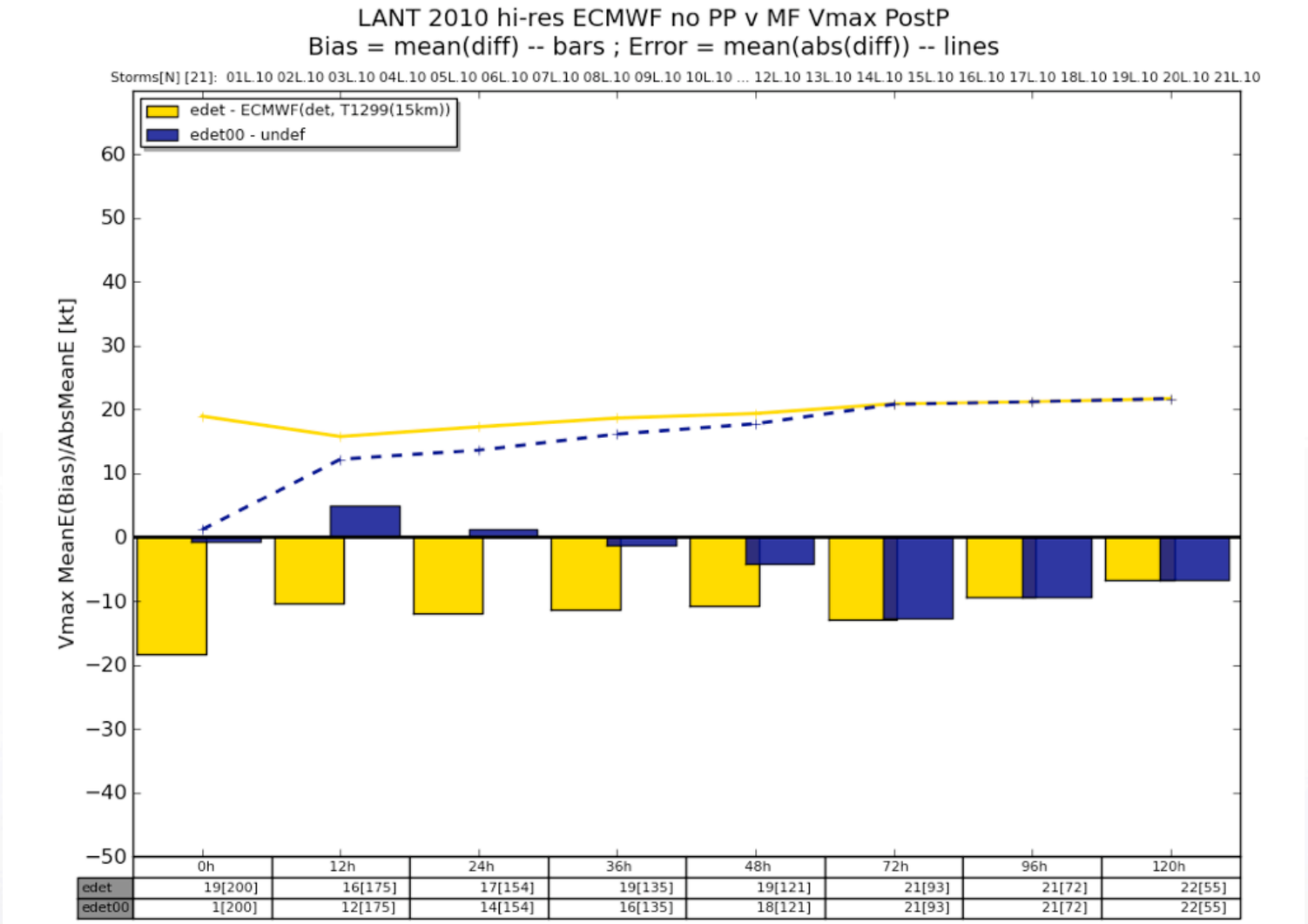
bias at τ0 ~ 18kt ⇒

model storm in hi-res data not only more intense but smaller compared to initial vortex

!!max Vmax @ τ36 = 123 kt with hi-res; 86 kt with 1°!!

- *huge diff between ecmwf tracker with full res grid (~20 km) v data grid at NCEP (~100km)*
- ***need full res grids from GFS (0.25°) vice 0.5°***

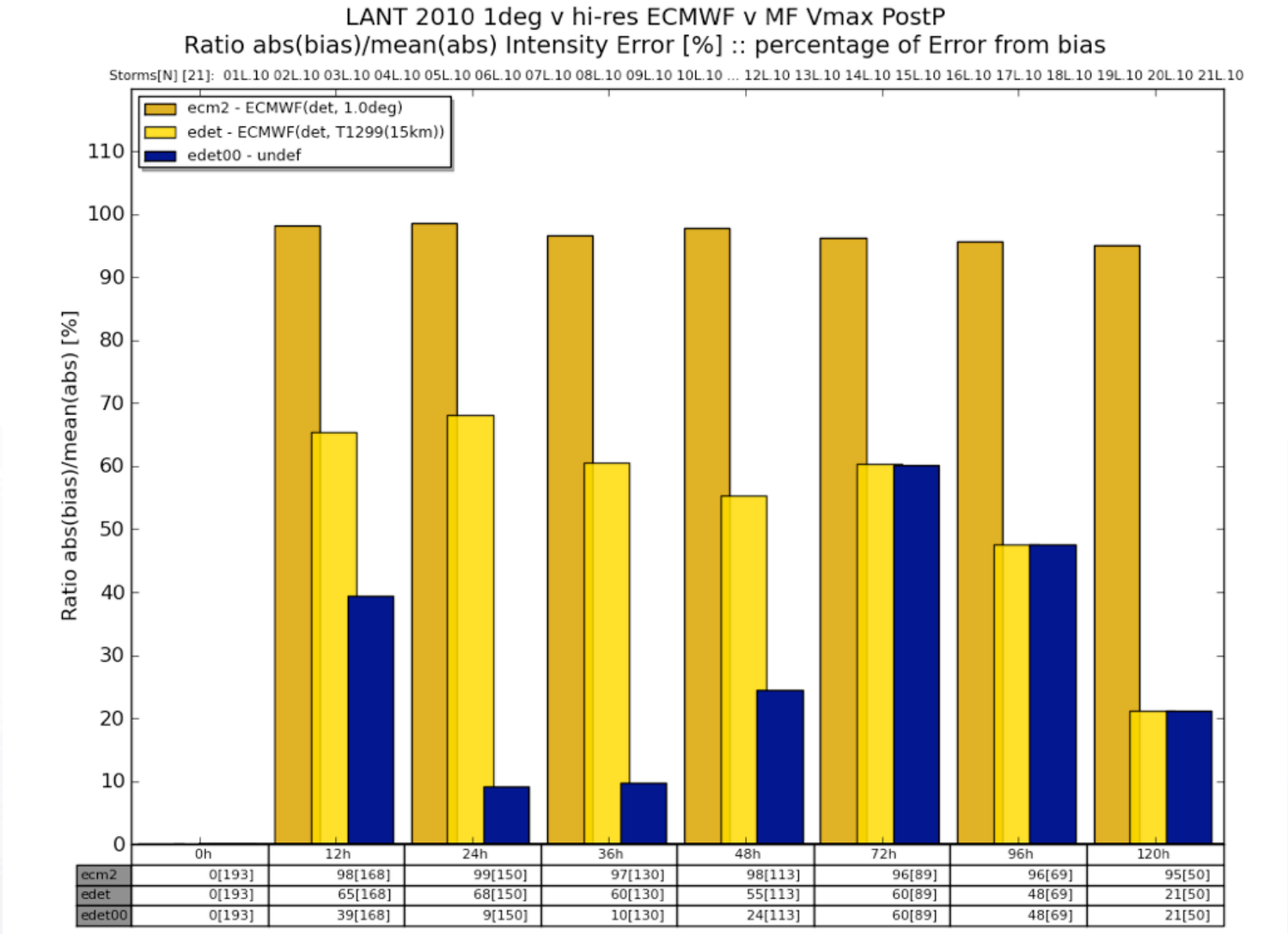
tracker PostP – ATCF 'I' tracks, but offset t=0 vice t=6



	0h	12h	24h	36h	48h	72h	96h	120h
edet	19[200]	16[175]	17[154]	19[135]	19[121]	21[93]	21[72]	22[55]
edet00	1[200]	12[175]	14[154]	16[135]	18[121]	21[93]	21[72]	22[55]

- *NHC PostP for Vmax :: α != 1.0 (smoothing), β = constant*
- *MF PostP :: α=1.0; β = f(τ) similar to GHMI (full Vmax offset at τ=0; 0 offset at τ=24) except offset goes to 0 at τ=72h*

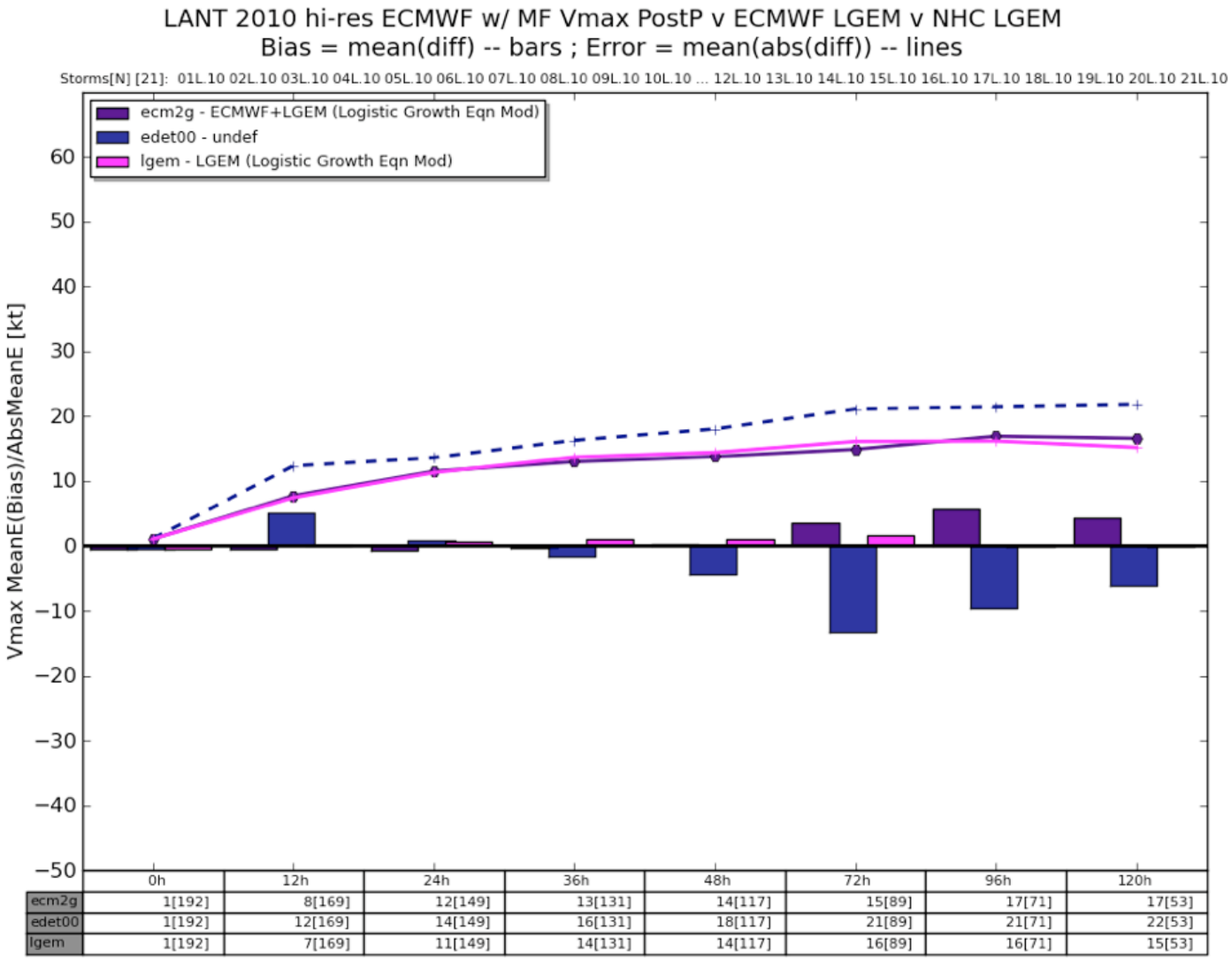
ratio bias/MAE



	0h	12h	24h	36h	48h	72h	96h	120h
ecm2	0[193]	98[168]	99[150]	97[130]	98[113]	96[89]	96[69]	95[50]
edet	0[193]	65[168]	68[150]	60[130]	55[113]	60[89]	48[69]	21[50]
edet00	0[193]	39[168]	9[150]	10[130]	24[113]	60[89]	48[69]	21[50]

- *MF PostP effective at reducing ratio bias/MAE*
- *full res has lower ratio v 1° grids*

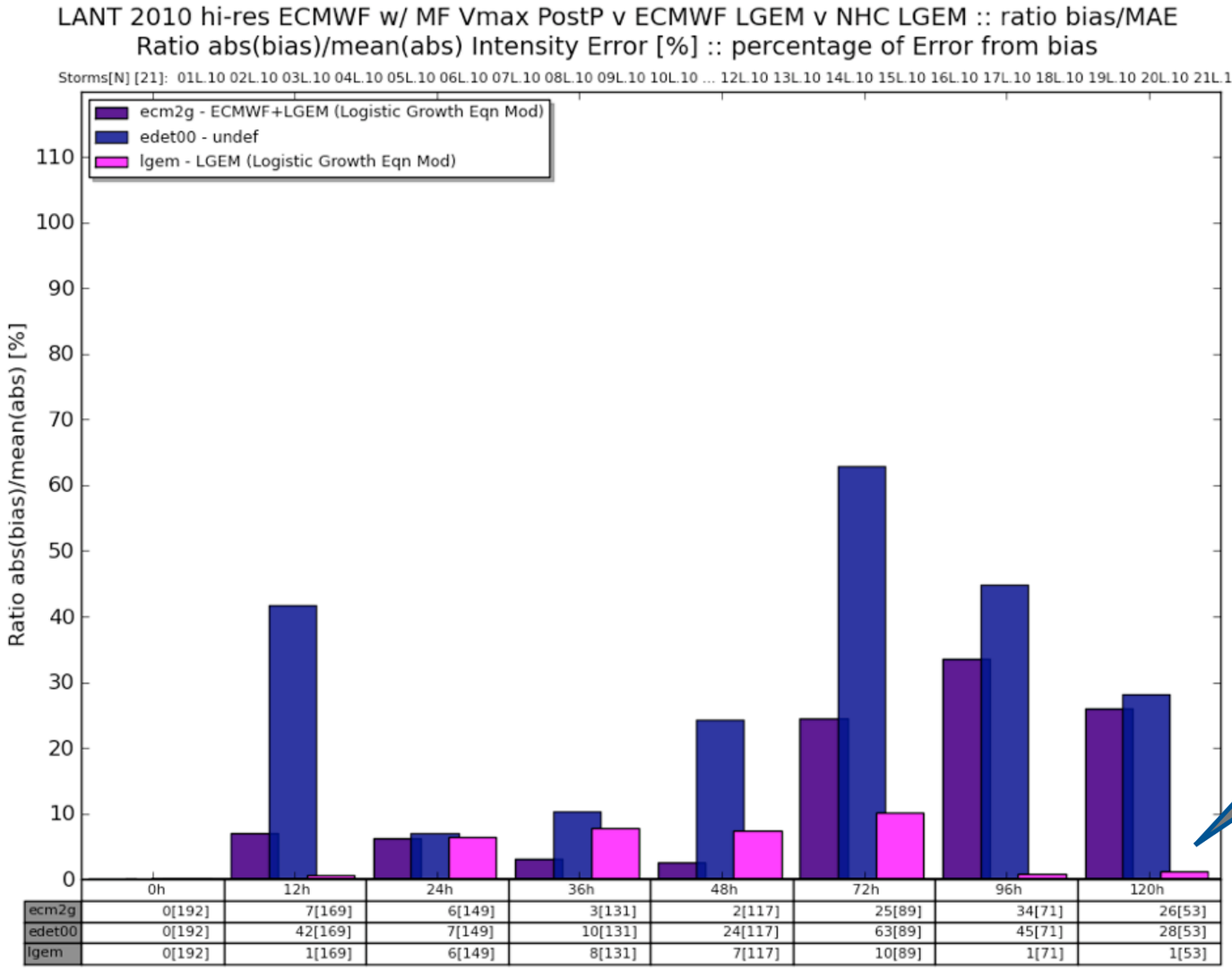
LGEM :: non-tracker PostP



	0h	12h	24h	36h	48h	72h	96h	120h
ecm2g	1[192]	8[169]	12[149]	13[131]	14[117]	15[89]	17[71]	17[53]
edet00	1[192]	12[169]	14[149]	16[131]	18[117]	21[89]	21[71]	22[53]
lgem	1[192]	7[169]	11[149]	14[131]	14[117]	16[89]	16[71]	15[53]

- *ECMWF LGEM ~ 15kt @ τ72; hfip baseline 16 kt*

LGEM :: non-tracker PostP



	0h	12h	24h	36h	48h	72h	96h	120h
ecm2g	0[192]	7[169]	6[149]	3[131]	2[117]	25[89]	34[71]	26[53]
edet00	0[192]	42[169]	7[149]	10[131]	24[117]	63[89]	45[71]	28[53]
lgem	0[192]	1[169]	6[149]	8[131]	7[117]	10[89]	1[71]	1[53]

NHC LGEM
best (lowest) ratio

comments/what's next...

- *hi-res ecmwf tracker*
  - has low V_{max} bias at τ120
  - *global model capable of making big winds (124 kt) !*
- *need to run tracker with full-res grids for intensity*
- *tracker v non-tracker PostP*
  - revise ATCF tracker PostP for intensity - make offsets function of τ
  - LGEM superior V_{max} forecast
- *MF tracker PostP*
  - experiment with different offset functions for both position and intensity; better tracker errors with no offset at τ72-120h
- *LGEM*
  - create diagfile for 'l' trackers
  - consensus of global model LGEM